Debbie Beadle

From: Evan Maxim
Sent: Friday, August 17, 2012 9:28 AM
To: Kamuron Gurol; Susan Cezar
Cc: Kathy Curry; Carl de Simas; Debbie Beadle
Subject: FW: More Limnology
Attachments: 12-05384-000 Krabbe letter 080312.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

FYI –

Public Comment

Evan Maxim
Senior Planner
City of Sammamish
425.295.0523

From: Greg Krabbe [mailto:gkrabbe@comcast.net]
Sent: Friday, August 17, 2012 8:43 AM
To: Evan Maxim
Subject: More Limnology

Evan,

This is an analysis we had Rob Zisette do to evaluate the impacts to the lake of a series of construction sites where TESC measures have failed. It indicates that for most sites, the impacts from a single failure would not adversely affect the lake. We would appreciate it if you would enter this into the record and perhaps have AMEC evaluate this too in their expanded BAS scope.

Thanks.

Greg Krabbe
GFK Consulting Inc
425 347 2898

EXHIBIT NO. 193

HERRERA

August 3, 2012

Mr. Greg Krabbe
KKBL Ventures 575 LTD
335 Park Place Center, Suite G111
Kirkland, WA 98033

Subject: Phosphorus loading from construction sites

Dear Greg:

At your request, I estimated total phosphorus loadings to Lake Sammamish from uncontrolled construction sites during large storm events. For this estimate, I used a simple model that calculates the volume of stormwater runoff discharged from 5-acre and 25-acre sites during 24-hour storms having return frequencies of 2, 10, 25, and 100 years. The storm precipitation depths are based on isopluvials for each return frequency at the southeast shoreline of Lake Sammamish, as shown in the 2009 King County Surface Water Design Manual. The storm runoff depths are based on the fraction of precipitation that is discharged from the site (runoff coefficient), which is estimated to range from 0.6 for the 2-year (water quality) storm to 0.8 for the 100-year storm.

I assumed the total phosphorus concentration in construction site runoff would range from 0.6 mg/L for the 2-year storm to 1 mg/L for the 100-year storm. This range is based on a limited number of total phosphorus measurements in runoff from construction sites located in Issaquah Highlands (0.6 mg/L maximum by Herrera 2003), Bellingham (0.2 mg/L maximum by Ecology 2004), and California (1 mg/L average at highway sites by CalTrans 2000). The model assumptions and results are presented in the attached table, and the results are expressed as a percentage of the total phosphorus loading to Lake Sammamish in Table 1.

Table 1. Estimated Percent of Total Phosphorus Loading to Lake Sammamish from Uncontrolled Construction Sites During Storm Events.

Site Area	2-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm
5 acres	0.003	0.01	0.01	0.01
25 acres	0.01	0.03	0.03	0.06

This simple model predicts that between 0.5 and 10 kilograms (kg) of total phosphorus would be discharge from a construction site, where the minimum value is for a 2-year

event at a 5-acre site and the maximum value is for a 100-year event at a 25-acre site. This range represents between 0.003 and 0.06 percent of the annual external phosphorus loading estimated for Lake Sammamish under existing conditions by the 1996 Lake Sammamish Water Quality Management Plan (16,713 kg/year in Table 12 on page 57). Results of this simple model suggest that the discharge of phosphorus from a small, uncontrolled construction site during a large storm event represents a very small fraction of the total phosphorus input into Lake Sammamish. This small amount would not result in a measurable change in lake water quality. The total phosphorus loadings estimated by this model are directly proportional the construction site area and, thus, can be extrapolated to larger construction sites.

I also used the universal soil loss equation (USLE) to estimate the phosphorus loading from uncontrolled construction sites for an entire year of bare soil exposure without erosion control. This approach estimated a high soil loss rate of 7 tons/acre/year based on the following input values: rainfall and erosivity index of 50 obtained from a map of the site area, average soil particle diameter of 5 millimeters for Alderwood soils, slope of 10 degrees, and length of 250 feet. The amount of soil loss was multiplied by an average soil phosphorus concentration of 500 mg/kg based on a map of soil test results by the U.S. Geological Survey.

The resulting phosphorus loading rate is 3 kg/acre/year. The phosphorus loading for a 5-acre site over a 1-year period is 15 kilograms, which is equivalent to 0.1 percent of the annual phosphorus loading to Lake Sammamish. This USLE estimate compares favorably to the simple model estimate of 0.01 percent for a single large storm event (see Table1), and can be extrapolated to larger construction sites. Comparison of the USLE estimate to the lake loading suggests that high rates of soil erosion from a 5-acre construction site over an entire year would not have a measurable impact on water quality in Lake Sammamish.

Sincerely,

Herrera Environmental Consultants, Inc.

Rob Zisette
Water Quality Principal

Attachment

Simple Model of Total Phosphorus Loading to Lake Sammamish from an Uncontrolled Construction Site for Large Storm Event Scenarios.

Model Input/Output	Unit	1a	1b	1c	1d	1a	1b	1c	1d
Construction site area	acres	25	25	25	25	5	5	5	5
24-hour storm return frequency	year	2	10	25	100	2	10	25	100
24-hour storm depth[a]	inches	2.5	3.6	3.9	4.8	2.5	3.6	3.9	4.8
Runoff coefficient[b]	fraction	0.6	0.7	0.7	0.8	0.6	0.7	0.7	0.8
Storm runoff depth	inches	1.5	2.5	2.7	3.8	1.5	2.5	2.7	3.8
Runoff volume	acre-ft	3.13	5.25	5.69	8.00	0.63	1.05	1.14	1.60
Runoff volume	cubic meters	3853	6473	7013	9864	771	1295	1403	1973
Runoff TP concentration[c]	mg/L	0.6	0.8	0.8	1.0	0.6	0.8	0.8	1.0
TP loading from site for event	kg	2.3	5.2	5.6	9.9	0.5	1.0	1.1	2.0
Annual TP loading to lake[d]	kg	16713	16713	16713	16713	16713	16713	16713	16713
TP loading from site as percent of total	%	**0.01**	**0.03**	**0.03**	**0.06**	**0.003**	**0.01**	**0.01**	**0.01**

[a] Based on isopluvials for SE shore of Lake Sammamish from 2009 King County Surface Water Design Manual

[b] Estimated for each storm depth

[c] Worst-case average based on limited data available for construction site runoff:

Issaquah Highlands construction site pond inflow (0.6 mg/L maximum of 15 samples by Herrera in 2002-03)

Bellingham construction sites (0.2 mg/L maximum of 8 samples by Ecology in 2004)

California highway construction sites (1 mg/L average by CalTrans in 1998-2000)

Average urban runoff value (0.4 mg/L in Welch and Jacoby 2004).

[d] Total existing loading from 1996 Lake Sammamish Management Plan